

sapphire amplifier at a 1-kHz repetition rate," Appl. Phys. B 70[Suppl.] S161-S164 2000 by Hentschel et al. (hereinafter "Hentschel"). This rejection is respectfully traversed.

At the outset Applicants are concerned with the above rejection for at least the following reasons. The Office Action characterizes Norris and Hentschel as allegedly being Applicant admitted prior art. This characterization is not appropriate. There has been no admission by the Applicants throughout prosecution of this application that either Norris or Hentschel represent prior art to the subject matter of the pending claims. Applicants disclosure discusses Norris at the paragraph beginning on page 3, line 29, which incorporates Norris by reference, as an example of an apparatus that was conventionally known at the time. There is no admission, however, that Norris constitutes prior art to the subject matter of the pending claims. With regard to the Hentschel reference, this reference was first applied in this application in a July 17, 2008 rejection of the pending claims listed on a Form PTO-892 attached to that rejection. There has been no admission by the Applicants that Hentschel constitutes prior art to the subject matter of the pending claims.

The second difficulty with the above rejection is that claims 1-4, 6-9, 11, 12, 14, 16 and 17, many of the same claims that are now rejected above, when these claims were broader (in an unamended form in a first Office Action) were rejected under 35 U.S.C. §103(a) as being unpatentable over Norris and Hentschel. Applicants' December 23, 2008 response to the then pending Office Action effectively overcame this rejection by arguing, in pertinent part, that Hentschel and Norris were not combinable in the manner suggested by the Office Action. This is an argument that will be reiterated, in detail, below based on the re-application of at least this combination of references in attempting to render obvious the subject matter of the pending claims.

This argument was also again presented to Examiner Zhang during the February 2 telephone interview. The Examiner indicated that, for the reasons set forth in the Office Action, the combination of Perry with Norris, and of Perry with Hentschel, rendered obvious the subject matter of the pending claims. The Examiner admitted that he was not necessarily indicating that Norris and Hentschel were combinable. Applicants' representative specifically traversed the Examiner's assertion in this regard noting that, based on the non-combinability of the Norris and Hentschel references, it was inappropriate to assert that one of ordinary skill may have predictably modified Perry with this combination of references with any reasonable expectation of success. Examiner Zhang remained unpersuaded by Applicants' representatives arguments in this regard. Notwithstanding the Examiner's assertions, Applicants maintain that at least Norris and Hentschel are not combinable in a manner that would render obvious the subject matter of the pending claim.

Previously having accepted Applicants' arguments regarding the non-applicability of the Norris and Hentschel references, it should be noted that an April 1, 2009 Final Rejection abandoned use of the Norris reference to reject the pending claims. That Final Rejection grounded rejections of the pending claims under 35 U.S.C. §103(a) over combinations of U.S. Patent No. 5,353,291 to Sprangle et al., and U.S. Patent Application Publication No. 2002/0149836 1 to Jovanovic et al., with Hentschel. In response, Applicants presented arguments regarding why the Sprangle and Jovanovic references were not combinable with Hentschel in the manner suggested by the Office Action. The pending Office Action abandons use of the Sprangle and Jovanovic references and now, as indicated above, asserts that Perry in view of Norris (reintroduced in this rejection) and Hentschel would have rendered obvious the subject matter of the pending claims. For the reasons set forth below, Applicants reassert that (1) Norris and Hentschel are not combinable in the manner suggested by the Office Action; and (2) Perry introduces no additional features that were not already

disclosed by the combination of those two previously-applied documents, the rejections over which were effectively traversed more than one year ago.

Claim 1 recites a laser system according to the principle of the regenerative amplifier, comprising: an amplifying laser medium, a laser resonator having at least one resonator mirror and at least one modulator, and a pump source for pumping the laser medium, wherein the laser resonator is designed to operate with a repetition rate of greater than 50kHz and has a pulse stretcher, inside a cavity of the resonator, as a specially designed component, the pulse stretcher having at least one of a structure- or material-related dispersive effect, the pulse stretcher having a minimum 3<sup>rd</sup> order dispersion with a maximum 2<sup>nd</sup> order dispersion.

For the reasons set forth in detail below, the currently-applied combination of Perry, Norris and Hentschel would not have rendered obvious the subject matter of at least independent claim 1.

Perry teaches laser machining of explosives. With specific reference to the details shown in Fig. 4 of Perry, it is clear that Perry includes a pulse stretcher that is located outside the cavity, not "inside a cavity of the resonator" as positively recited in independent claim 1. Specifically at col. 6, lines 61 and below, Perry refers to the features of pulse stretcher 48 as consisting of "an 1800 1/mm grading 50, a flat mirror 52 (in the Fourier plane) and a spherical mirror 54 (*e.g.*, a parabolic mirror). Review of Fig. 4 of Perry indicates that the pulse stretcher is located outside the cavity. Further, this Figure shows a complex design with several components being positioned relative to one another at specific angles and with space between them. In this regard Perry does not (1) disclose a pulse stretcher inside the cavity, or (2) provide any basis by which to assert any motivation for integrating these cumbersome and bulky components of a pulse stretcher into a regenerative amplifier. For completeness, Perry also fails to disclose a pulse stretcher as a specially designed component having a structure- and/or material-related dispersive effect, the pulse stretcher having minimum 3<sup>rd</sup> order

dispersion with maximum 2<sup>nd</sup> order dispersion. Certain of these features have been previously identified throughout prosecution of this application as specifically being lacking in the Norris reference as well. The subject matter of the pending claims is directed to a compact design in a reduced complexity in such laser systems that is clearly not present in the Perry reference (see, *e.g.*, Fig. 4 and the accompanying description in Perry).

Regarding the Norris reference, the previous Office Actions have been clear that Norris "does not disclose wherein the laser resonator has a pulse stretcher as a specially designed component having a structure- and/or material related dispersive effect, the pulse stretcher having minimum 3<sup>rd</sup> order dispersion with maximum 2<sup>nd</sup> order dispersion," as is positively recited in the pending claims. In this regard, the addition of Perry to the previously-asserted combination of Norris and Hentschel adds nothing. The shortfalls in the application of the Hentschel reference were previously discussed in detail in Applicants' prior responses. That argument will be reiterated in some detail below.

Hentschel teaches at, *e.g.*, page S162, 2 "Due to this broad bandwidth, the material dispersion of a 10-cm-long SF57 glass block and the Faraday isolator at the entrance of the amplifier is sufficient to stretch the pulses up to  $\approx 20$ ps. This grating-less stretching technique provides high efficiency and no need for alignment. After temporal shaping, the pulse train is injected into a multi pass amplifier arrangement." Thus, Hentschel teaches the 10-cm-long SF57 glass block at the entrance of the amplifier Hentschel. This placement would not have suggested a pulse stretcher, inside a cavity of the resonator, with all of the other features positively recited in claim 1.

It should be noted that for external-cavity components restrictions of intra-cavity use do not exist. In this regard bulky systems such as those shown in, for example, Perry are subject to inherent difficulty in their setup as is discussed, for example, in Applicants' disclosure at least at page 2, lines 1-12. The two significant shortfalls that are noted in the

Background section of Applicants' disclosure regarding prior art laser devices, particularly with regenerative amplifiers or with chirped pulse regenerative amplification are that they "are often limited by the size of the required pulse stretcher/compressor unit," "the necessity of an expensive and bulky pump laser," and "the external components especially in the pulse stretcher, result in a greater complexity and increased effort for the adjustment." The subject matter of the pending claims is designed to address these very shortfalls.

Moreover, as was asserted in Applicants June 17, 2009 Amendment, and reiterated in a July 14, 2009 personal interview with the Examiner, the setup of Hentschel is designed for repetition rates of 1kHz, which is well below the "at least 50kHz" of the subject matter of the pending claims. The Examiner agreed, in an interview summary from the July 14, 2009 interview with Applicants arguments that "Hentschel et al. do not disclose a repetition rate of 50kHz." In this regard the disclosure of Hentschel is specifically distinguished from that of Perry and/or Norris, which operate at high repetition rates, and any predictability to the combination of these references is, therefore, lost. In short, Hentschel neither teaches to incorporate a pulse stretcher component into a cavity, nor does the reference provide any of the necessary details, and specifically is designed to operate with differing operating parameters that would lead one of ordinary skill in the art away from making the asserted combination.

Another simple manner by which to explain certain of the differences leading to non-compatibility of the references is that Hentschel produces mJ-pulses with a rate of approximately 1kHz, whereas the pending claims, and certain of the other references, are directed to microjoule pulses with repetition rates above 50kHz. Specifically, Perry at, for example, col. 1, lines 34-42, indicates that the invention produces a pulsed output beam having a selectively variable pulse duration with "[t]he energy per pulse obtainable from the laser system [being] variable from one microjoule to over five microjoules." It is known to

those of ordinary skill in the art that pulse repetition rates and pulse energies are dependent. As such, it is not as simple as the Office Action suggests to combine the references in the manner suggested. Put another way, as has been argued previously, pulse energy and repetition rates are closely related and are not arbitrarily exchangeable. An increase in repetition rate leads to a decrease in the maximum pulse length that can be used in the cavity. The decrease in pulse length leads to reduced pulse energies due to the fact that the intensity has to remain below a damaged threshold. Conversely, the pulse length that must be achieved determines the necessity for, and type of, stretcher component. It is for this reason that conditions for low repetition rate high pulse energy setups, such as those described in Hentschel, are not combinable with high repetition rate, low pulse energy setups such as those described in Norris, Perry, and in the subject matter of the pending claims.

The above-described dramatic difference in operating parameters for the differing systems was the basis for Applicants' previous arguments that Norris and Hentschel are not combinable in the manner suggested by the Office Action. Applicants feel that they are prejudiced by having to reassert an argument which was previously accepted by the Patent Office with regard to the Norris and Hentschel references. The arguments are no different regarding the Perry and Hentschel references and Applicants understand that these arguments have been previously accepted and that the Examiner has also previously accepted the incompatibility of the Hentschel reference with the positively-recited repetition rate range of "greater than 50kHz." At paragraphs 8 and 9, the Office Action, in a somewhat disjointed manner, asserts the combinability of Norris with Perry, and Hentschel with Perry, as discussed above. The assertions in the Office Action ignore the above discussion and Applicants' previous argument regarding the combinability discussed below.

Hentschel teaches at, *e.g.*, page S161, first paragraph after the Abstract lines 12-14 "[i]n this paper we report for the first time, a [1-]kHz laser generating 0.1 TW pulses." Thus,

Hentschel teaches at most a repetition rate of 1kHz. Applicants' specification at page 1, line 34 - page 5, line 14 details many conventional laser arrangements. Applicants' disclosure specifically points out that repetition rates for lasers with an external pulse stretcher have not exceeded 10kHz-20 kHz. Thus, if the 10-cm-long SF57 glass block Hentschel were combined with the inventions of Norris or Perry the laser could not have operated at repetition rates of 50kHz, as recited in claim 1. Further, the laser of Norris, for example, is specifically for high (250kHz repetitions rates). Thus, it would not have been predictable to combine the 10-cm-long SF57 glass block of Hentschel with the inventions of Norris or Perry without impermissibly changing the principles of operation of the Norris or Perry devices.

Applicants' representative presented the totality of the above arguments to Examiner Zhang during the February 2 telephone interview. Specifically, Applicants' representative noted that the previous rejection over the Norris and Hentschel references had been overcome based on Applicants' arguments. Further, Applicants' representative noted that the addition of the Perry reference adds nothing to what was of record in the previous rejections. Examiner Zhang responded by indicating that Norris and Perry were, in his opinion, combinable and that he was relying only on Hentschel for the specific feature that the Office Action concedes Perry and Norris do not teach. This assertion appears to sidestep Applicants' arguments that Norris and Hentschel are not combinable. And, for the reasons set forth above, it is clear that equally Perry and Hentschel are not combinable in the manner suggested by the Office Action. Applicants' representative indicated that it is necessary to consider what the references teach "as a whole" and not to selectively pull out features that another reference lacks and then simply to assert, in conclusory manner, some manner by which the references are alleged to be combinable. Examiner Zhang remained unpersuaded by many of the arguments presented by Applicants' representative. In response to an assertion that references that teach low repetition rate, high pulse energy laser setup are viewed by those of ordinary

skill in the art differently from references that teach high repetition rate, low energy setup, the Examiner appeared to agree. Regardless of this apparent agreement, however, Examiner Zhang maintained his position that, having found each of the recited features allegedly taught by one or more references, he could combine those references based on their alleged relationships in the manner that he had done in this Office Action. Applicants do not believe that the Office Action meets the applicable standard for showing combinability of the references for all of the reasons set forth above and therefore believe that the §103 rejection of claim 1, and the claims depending therefrom, over the asserted combination of applied references is in error.

For at least the foregoing reasons, Perry, Norris and Hentschel are not combinable in the manner suggested. Also, the combination of Perry Norris and Hentschel cannot reasonably be considered to have rendered obvious the combination of all of the features recited claim 1. Also, the combination of Perry, Norris and Hentschel cannot reasonably be considered to have rendered obvious the combinations of all of the features recited in claims 2-9, 11, 12, 14, 16 and 17 for at least the dependence of these claims on an allowable base claim, as well as for the separately patentable subject matter that each of these claims recites.

Accordingly, reconsideration and withdrawal of the rejection of claims 1-9, 11, 12, 14, 16 and 17 under 35 U.S.C. 103(a) as being unpatentable over Perry, Norris and Hentschel are respectfully requested.

The Office Action rejects claims 10 and 15 under 35 U.S.C. §103(a) as being unpatentable over Perry, Norris and Hentschel and further in view of "Large-ratio stretch and compression of sub-10-fs pulses utilizing dispersion managed devices and a spacial light modulator," Appl. Phys. B74 [Suppl.], S253-257 2002 to Takada et al. (hereinafter "Takada"). This rejection is respectfully traversed.



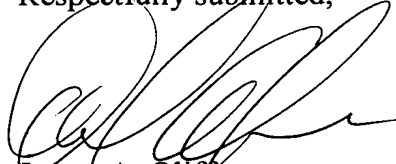
The Office Action concedes that Perry, Norris and Hentschel do not teach wherein the pulse compressor has a dispersive grating having less than 1200 lines/mm. The Office Action asserts that Takada remedies these shortfalls of Perry, Norris and Hentschel. However, as argued above, Perry, Norris and Hentschel cannot reasonably be considered to have rendered obvious the combination of all of the features recited in claim 1. Takada, as applied to claim 1, does not remedy these shortfalls of Perry, Norris and Hentschel. Therefore, the combination of Perry, Norris, Hentschel and Takada cannot reasonably be considered to have rendered obvious the combinations of all of the features recited claims 10 and 15 for at least the dependence of these claims on allowable base claims, as well as for the separately patentable subject matter that each of these claims recites.

Accordingly, reconsideration and withdrawal of the rejection of claims 10 and 15 under 35 U.S.C. 103(a) as being unpatentable over Perry, Norris, Hentschel and Takada are respectfully requested.

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-17 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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